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# LIQUID CRYSTAL DISPLAY WITH BUILT-IN TOUCH SCREEN HAVING PARTICLES FOR PRESSURE CONCENTRATION

## REFERENCE TO RELATED APPLICATION

The present application claims the benefit of priority of Korean Patent Application No. 10-2006-0041786 filed on May 10, 2006 in the Korean Intellectual Property Office.

## FIELD OF THE INVENTION

The present invention relates to a liquid crystal display panel having a built-in touch screen and a liquid crystal display (LCD) having the same.

## DESCRIPTION OF THE RELATED ART

FIG. 1 is a schematic sectional view of a conventional LCD panel with a built-in touch screen having a color filter substrate 10 including a plurality of color filters 13, a thin film transistor (TFT) substrate 20 including a plurality of pixels 26, a liquid crystal layer 30 between color filter substrate 10 and TFT substrate 20, and polarizing plates 41 and 42 attached to the outer surfaces of the substrates. A sensing unit which is composed of a conductive column spacer 17 and a pad 27 spaced apart from conductive column spacer 17 by a predetermined interval is formed between the substrates to sense touch points.

The touch screen so configured induces sensing unit to operate by touching an upper substrate, i.e. color filter substrate 10. That is, if color filter substrate 10 is touched, the gap changes between conductive column spacer 17 and the pad 27 causing a detectable change in resistance at the touch point. However, in the aforementioned structure, touch sensitivity depends on touch circumstances. That is, the touch sensitivity is high when a relatively rigid bar having a relatively small contact area is used, (case 'A'), whereas the touch sensitivity is low when a relatively soft tool having a large contact area, e.g. a finger or the like, is used, (case 'B').

## SUMMARY OF THE INVENTION

The present invention provides a liquid crystal display (LCD) panel with a built-in touch screen having improved touch sensitivity regardless of the characteristics of the contacting instrumentality. According to an aspect of the present invention the touch screen, comprises a first substrate; a second substrate positioned opposite to first substrate; a liquid crystal layer between first and second substrates; a sensing unit including a conductive column spacer and a conductive pad spaced apart from conductive column spacer by a predetermined interval to sense a touch point; and a plurality of pressure particles exhibiting a predetermined degree of hardness positioned on an outer surface of first substrate. The LCD panel of the present invention may further comprise first and second polarizing plates attached respectively to outer surfaces of first and second substrates.

Preferably, first substrate comprises a transparent insulative substrate, a black matrix for blocking light, a plurality of color filters, and a common electrode formed on an entire surface of the plurality of color filters, wherein conductive column spacer is formed on first substrate.

Preferably, conductive column spacer is formed on the black matrix.

Preferably, conductive column spacer is composed of a projection made of an insulative material and a conductive layer formed on the projection.

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Preferably, conductive column spacer is composed of a projection made of a conductive material. Preferably, the spacer includes a ball spacer or column spacer; pressure particles is in the form of a ball; the size of pressure particles is 1 to 100  $\mu\text{m}$ . Preferably, the plurality of pressure particles are dropped at positions corresponding to conductive column spacer and conductive pad and are dispersed on the outer surface of first substrate at a predetermined dispersion density.

Preferably, the plurality of pressure particle are dispersed on an adhesive layer of first polarizing plate at a predetermined dispersion density.

The LCD panel may further comprise a controller for receiving a signal from sensing unit to detect a voltage change and to create a coordinate of a touch point; and a driver for receiving the coordinate from the controller to operate a pointer.

According to another aspect of the present invention, there is provided an LCD, comprising an LCD panel with a built-in touch screen including a first substrate, a second substrate positioned opposite to first substrate, a liquid crystal layer injected between first and second substrates, a sensing unit including a conductive column spacer and a conductive pad spaced apart from conductive column spacer by a predetermined interval to sense a touch point, and a plurality of pressure particles with certain hardness positioned on an outer surface of first substrate; and a backlight for providing light to the LCD panel.

## BRIEF DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages of the present invention may become apparent from a reading of the ensuing description together with the drawing, in which:

FIG. 1 is a schematic sectional view of a liquid crystal display (LCD) panel with a built-in touch screen according to a related art;

FIG. 2 is a schematic sectional view of an LCD panel with a built-in touch screen according to the present invention;

FIG. 3 is a view illustrating a finger touching an LCD panel with a built-in touch screen according to the present invention;

FIG. 4 is a block diagram schematically illustrating functions of a touch screen of the LCD panel with a built-in touch screen according to the present invention;

FIG. 5 is a schematic plan view of the LCD panel with a built-in touch screen according to the present invention;

FIGS. 6A to 6D are sectional views illustrating a process of manufacturing an example of a color filter substrate in the LCD panel with a built-in touch screen according to the present invention;

FIG. 7 is a sectional view showing another example of color filter substrate in the LCD panel with a built-in touch screen according to the present invention;

FIGS. 8A to 8E are sectional views illustrating a process of manufacturing an example of a thin film transistor substrate in the LCD panel with a built-in touch screen according to the present invention; and

FIGS. 9A to 11B are views illustrating methods of arranging pressure particles on the LCD panel with a built-in touch screen according to the present invention, respectively.

## DESCRIPTION OF THE INVENTION

An expression that one element such as a layer, film, region or plate is placed on or above the other element indicates not only a case where the element is placed directly on or above